

SERVICE MANUAL

DATSUN PICK-UP
MODEL 620 SERIES
CHASSIS & BODY



NISSAN MOTOR CO., LTD.
TOKYO, JAPAN

SECTION BR

BRAKE SYSTEM

BR

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BRAKE SYSTEM

BRAKES

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DESCRIPTION

The 620 series models use hydraulically operated brakes; uni-servo type brakes on the front and duo-servo type brakes on the rear.

The combination of the master cylinder and Master-Vac is as described below:

1. On the vehicles equipped with the Master-Vac, the cylinder diameter of the tandem master cylinder is 19.05 mm ($\frac{3}{4}$ in). This main cylinder system is established as standard equipment for the model PL620TU and optional equipment for all models except column shift L.H. drive vehicles.

2. On the vehicles equipped with only tandem master cylinder (without Master-Vac), the master cylinder diameter is 17.46 mm ($\frac{11}{16}$ in). This system is set up as optional equipment for all models except column shift L.H. drive vehicles.

3. The cylinder diameter of the single master cylinder is 17.46 mm ($\frac{11}{16}$ in).

The hand brake is of a mechanical type, which serves to brake the rear

wheels. It is applied or released through the stick-type hand brake lever in the driver's compartment. As these brakes are applied, the brake

warning lamp, located on the instrument panel, will come on to indicate that the hand brake is in "applied" condition.

ADJUSTMENT

Brake pedal

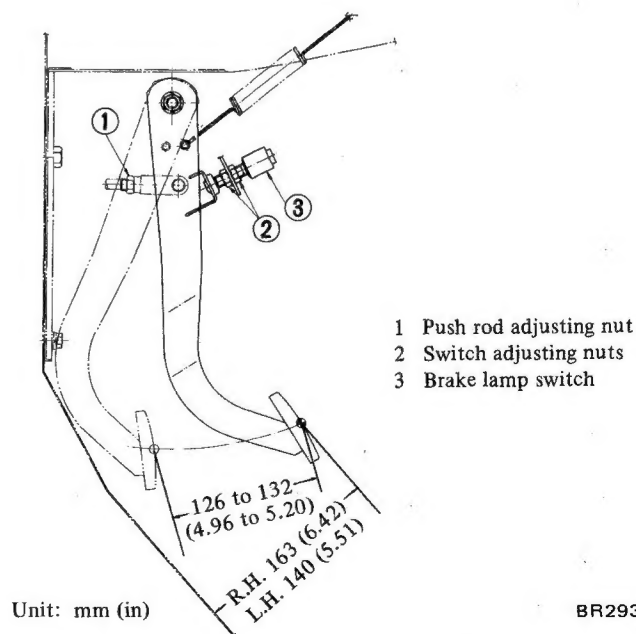


Fig. BR-1 Adjusting brake pedal

BRAKE SYSTEM

1. Under the condition that the push rod of brake lamp, switch is pushed in, position the height of brake pedal from toeboard to be 163 mm (6.42 in) for R.H. drive and 140 mm (5.51 in) for L.H. drive vehicles, operating the switch adjusting nuts. Then, tighten nuts securely.

Tightening torque:

1.2 to 1.5 kg-m
(8.7 to 11 ft-lb)

2. Adjust the length of push rod with its adjusting nut so as to become 1 to 3 mm (0.0394 to 0.1181 in) in play when depressing brake pedal. Then, tighten nut securely.

Tightening torque:

1.9 to 2.4 kg-m
(14 to 17 ft-lb)

Note: Take care not to allow the push rod getting into master cylinder in free condition.

3. After completing adjustment, operate brake pedal several times to insure that it travels over its entire stroke 126 to 132 mm (4.96 to 5.20 in) smoothly without showing squeak noise, twisting or interference.

Front brake

1. Raise vehicle until wheel clear floor.
2. Remove rubber boot from brake disc.
3. Lightly tap adjuster housing and move it forward. Turn down adjuster wheel with a screwdriver, and spread brake shoes. Stop turning adjuster wheel when a considerable drag is felt and lock up brake drum.

Note: For both left and right brakes, brake shoes spread when adjuster wheel is turned downward.

4. Return adjuster wheel 12 ratches to obtain correct clearance between brake drum and brake shoes. Turn brake drum, and make sure that brake drum turns without dragging when brake shoes interfere with brake drum, readjust clearance.
5. Install rubber boot.

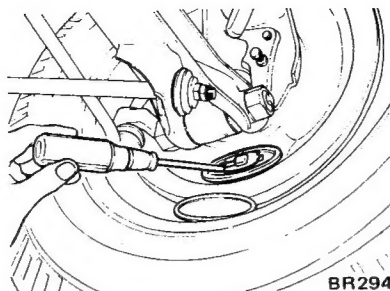


Fig. BR-2 Adjusting front brake

Rear brake

With hand brake fully released, adjust rear brake shoe clearance. For the service procedures, refer to "Front brake."

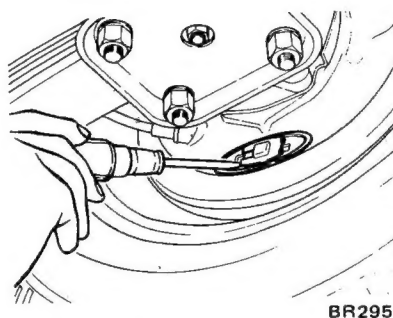


Fig. BR-3 Adjusting rear brake

Hand brake (Parking brake)

1. Raise vehicle until rear wheels are clear of the floor.
2. Apply hand brake lever, operate lock nuts to be 80 to 100 mm (3.15 to 3.94 in) in hand brake lever stroke, and tighten lock nuts securely.

Applying force to hand brake lever: 20 to 30 kg (44 to 66 lb)

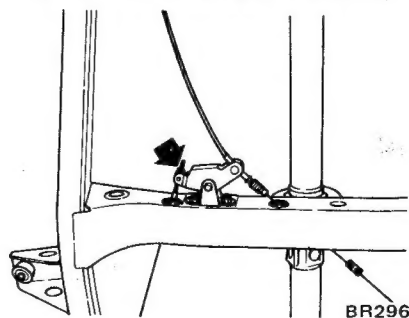


Fig. BR-4 Adjusting lock nut

3. Fully release hand brake and rotate rear wheels. No drag should be present.

Notes:

- Before adjusting hand brake, complete the adjustment of rear brakes.
- After adjusting hand brake, operate the brake lever to make cable stable.
- Hand brake must be operated smoothly while being pulled and released. Make sure that no abnormal noise, dragging, twisting or other faulty condition occurs.

Bleeding hydraulic system

Hydraulic brake system must be bled whenever any line has been disconnected or air has in some way entered this system.

When pedal feeling is "spongy" pedal action, it is an indication that air has entered in the system.

Bleeding hydraulic system deserves much attention as it is an essential factor for regular brake service operation.

- Clean all dirt around master cylinder reservoir, remove cylinder cover and top up reservoir with recommended brake fluid.
- Thoroughly clean mud or dust from bleeder valve so that outlet hole is free from any foreign material. Install a bleeder hose to bleeder valve.

Dip the other end of hose in a container filled with brake fluid.

- Depress brake pedal two or three times and keep pedal fully depressed.
- With brake pedal fully depressed, open bleeder valve to exhaust air.

Notes:

- Carefully monitor brake fluid level at master cylinder during bleeding operation.
- Do not re-use brake fluid drained during bleeding operation.
- Bleed air in the following sequence.
Rear wheel → Front wheel
- Exercise care not to splash brake fluid on painted portions.

- Close bleeder valve quickly as brake pedal is on down stroke.
- Allow brake pedal to return slowly with bleeder screw closed.

BRAKE SYSTEM

7. Repeat bleeding operations until no air bubbles show in hose.

Notes:

- Brake fluid containing air is white and contains air bubbles.
- Brake fluid containing no air runs out of bleeder valve in a solid stream free of air bubbles.

8. Repeat above steps on the remaining brake line to expel air.

BRAKE PEDAL

Removal

- Remove pedal return spring.

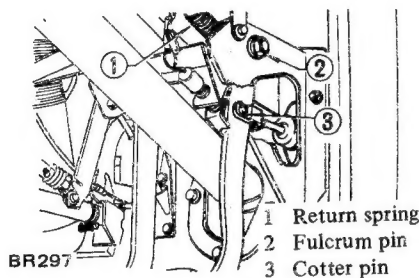


Fig. BR-5 Brake pedal mounting

- Remove cotter pin from clevis pin, and separate pedal from (Master-Vac) push rod.

- Remove fulcrum pin and pedal.

Note: Loosen fulcrum pin counter-clockwise on R.H. drive and clockwise on L.H. drive vehicles.

Installation

Install brake pedal in the reverse sequence to removal, paying attention to the following instructions.

- Insert fulcrum pin from left hand side for R.H. drive and from right hand side for L.H. drive vehicle.
- Install clevis pin from left hand side.
- Hook return spring to brake pedal assembly from clutch pedal side on R.H. drive and operate it from reverse side on L.H. drive vehicles.
- Apply a coating of recommended multipurpose grease to the inner and outer faces of pedal bushing, clevis pin, and hooks of return spring. Charge the clearances in bushings with grease.

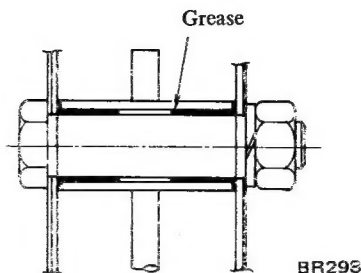


Fig. BR-6 Greasing place

- Adjust the brake pedal after installation. (Refer to the instructions under "Adjustment.")

Tightening torque:

Fulcrum pin 1.9 to 2.4 kg-m
(14 to 17 ft-lb)

Inspection

Check brake pedal for the following items, servicing as necessary.

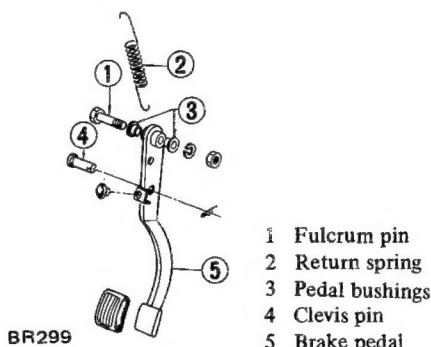


Fig. BR-7 Brake pedal

- Check pedal bushing for wear, deformation or damage.

- Check pedal shaft sleeve for wear or roughness.
- Check for bent brake pedal.
- Check for fatigued return spring.

MASTER CYLINDER

Three kinds of the master cylinder are used on the vehicles; that is, the diameters of cylinder are 17.46 mm ($\frac{11}{16}$ in) for single and tandem master cylinders, and 19.05 mm ($\frac{3}{4}$ in) for tandem master cylinder. The tandem master cylinder contains two fluid reservoirs which connect the front and rear brake lines independently.

Braking force is constantly maintained when failure occurs in either the front brake system or the rear brake system. Failure in the front brake system will leave the rear brake still operative or failure in the rear brake system will leave the front brake system still operative.

The reservoir is equipped with a retention cap. To remove this cup, proceed as follows:

- Turn retention ring fully in the REMOVE direction.
- Pull out retention cap.

To install it, proceed as follows:

- Turn retention ring (used in the retention cap) fully in the REMOVE direction.
- Align the projection in retention ring with the slit in the reservoir tank and push retention cap in the tank.
- Turn retention ring fully in the TIGHTEN direction.

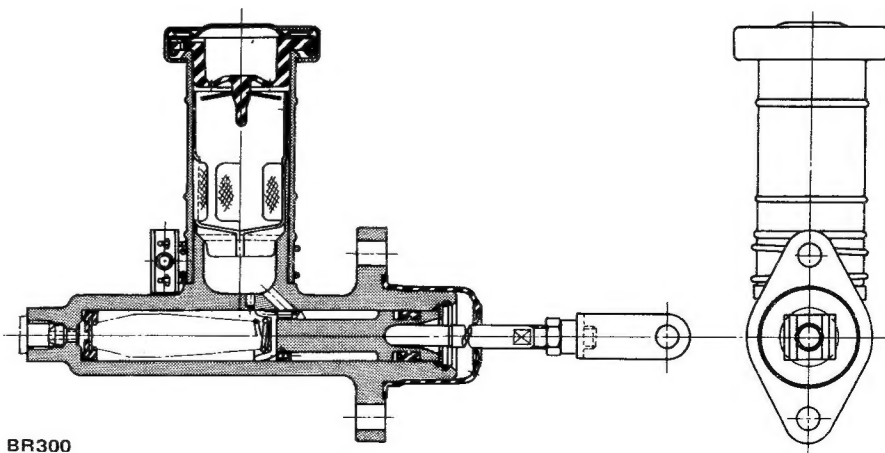
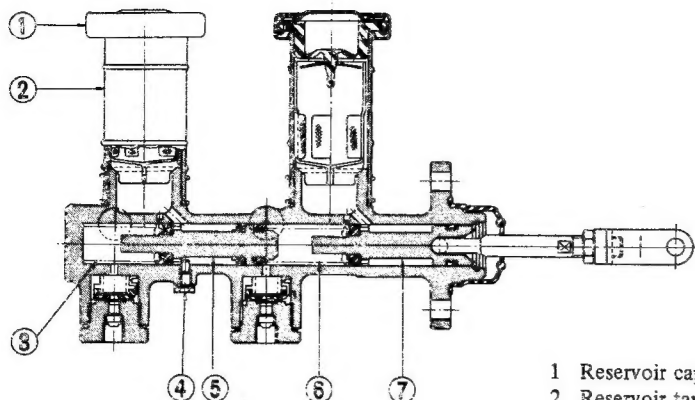


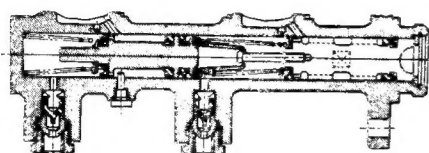
Fig. BR-8 Sectional view of single master cylinder (Made by Nabco)

BRAKE SYSTEM

Tokico



Nabco



BR301

- 1 Reservoir cap
- 2 Reservoir tank
- 3 Secondary piston return spring
- 4 Stopper screw
- 5 Secondary piston
- 6 Primary piston return spring
- 7 Primary piston

5. Bleed air out of master cylinder after it is installed in its original position.

Tightening torque:

Brake master cylinder attaching nut: 0.8 to 1.2 kg-m
(5.8 to 8.7 ft-lb)

Brake tube connector: 1.5 to 1.8 kg-m
(11 to 13 ft-lb)

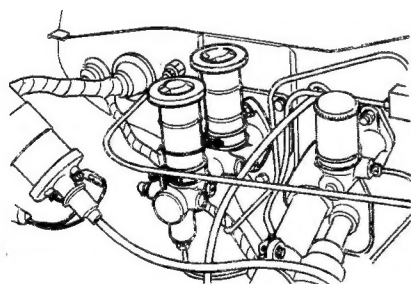
Fig. BR-9 Sectional view of tandem master cylinder

Removal and installation

1. On the vehicle not equipped with the Master-Vac:

Pull out clevis pin, and separate brake pedal from master cylinder push rod.

2. Disconnect brake tube from master cylinder.



BR302

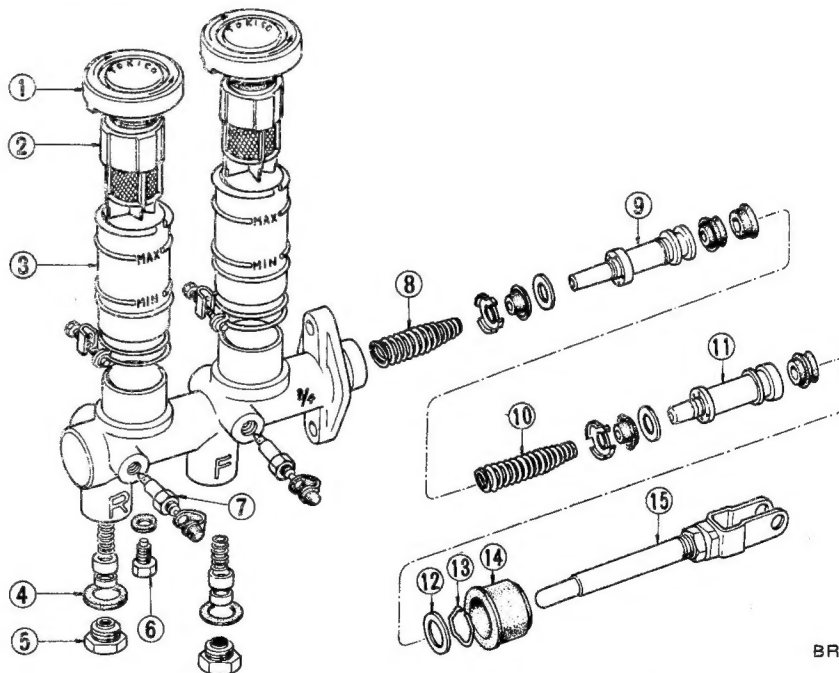
Fig. BR-10 Master cylinder

3. Remove master cylinder securing nuts, and withdraw master cylinder from engine room side.

Note: Before disconnecting brake tube, be sure to use a container that receives draining brake fluid. Use of a rag is also suggested to keep adjacent parts and place clean at all times.

4. Install master cylinder in the reverse sequence to removal.

Disassembly and assembly



BR303

- | | | |
|-----------------|----------------------------|------------------------|
| 1 Reservoir cap | 6 Secondary piston stopper | 11 Primary piston |
| 2 Oil filter | 7 Bleeder screw | 12 Piston stopper |
| 3 Oil reservoir | 8 Secondary return spring | 13 Piston stopper ring |
| 4 Packing | 9 Secondary piston | 14 Dust cover |
| 5 Valve cap | 10 Primary return spring | 15 Push rod assembly |

Fig. BR-11 Master cylinder

1. Remove reservoir cap and filter and drain out brake fluid.
2. Pry off stopper ring, using a screwdriver.

3. Remove stopper screw and take out stopper, primary piston assembly, spring, and secondary piston assembly, in the order shown.

BRAKE SYSTEM

Note: Discard piston cup if it is removed from piston assembly and use a new one.

4. Unscrew plug to gain accessibility of check valve for disassembling.

Note: Never detach reservoir tank. If it is removed for any reason, discard it and install a new one.

5. Assemble master cylinder in the reverse sequence to disassembly, paying particular attention to the following notes:

Tightening torque:

Valve cap:

Tokico	8 to 9 kg-m (58 to 65 ft-lb)
Nabco	2.5 to 3.5 kg-m (18 to 25 ft-lb)

Bleeder: 0.7 to 0.9 kg-m
(5.1 to 6.5 ft-lb)

Notes:

- a. Replace gaskets and packings with new ones.
- b. Apply brake fluid or rubber grease to sliding contact surfaces of parts to facilitate assembly of master cylinder.

do not immerse them in it longer than 30 seconds. After parts are cleaned, dry with compressed air.

1. Check cylinder and position for evidence of abnormal wear or damage. Replace if found defective.
2. Check piston-to-cylinder clearance. If it is more than 0.15 mm (0.0059 in), replace either piston or cylinder.

Master cylinder inner diameter:

19.05 mm ($\frac{3}{4}$ in)
17.46 mm ($\frac{11}{16}$ in)

Inspection

Thoroughly clean all parts in a suitable solvent, and check for worn or damaged parts. Replace any part that is defective.

Note: Do not clean rubber parts with mineral oil since this will be the sure way of deteriorating parts. Use brake fluid or alcohol. When alcohol is used for cleaning these parts,

3. Check for weakened, fatigued or damaged springs, and replace if necessary.

Piston return springs

Maker	Type		Free length mm (in)	Dia. of spring mm (in)	Installed	
					Length mm (in)	Load kg (lb)
Tokico	19.05 mm ($\frac{3}{4}$ in) Tandem master cylinder	Primary side	53 to 57 (2.087 to 2.244)	1.2 (0.047)	35.7 (1.406)	1.8 to 2.2 (4.0 to 4.9)
		Secondary side	54 to 55 (2.126 to 2.165)	1.6 (0.063)	34.5 (1.358)	3.6 to 4.4 (7.9 to 9.7)
	17.46 mm ($\frac{11}{16}$ in) Tandem master cylinder	Primary side	52 to 53 (2.047 to 2.087)	1.2 (0.047)	31.0 (1.221)	1.8 to 2.2 (4.0 to 4.9)
		Secondary side	44 (1.732)	1.6 (0.063)	30.5 (1.201)	3.6 to 4.4 (7.9 to 9.7)
	17.46 mm ($\frac{11}{16}$ in) Single master cylinder		85 to 86 (3.347 to 3.386)	1.2 (0.047)	61.5 (2.421)	1.2 to 1.4 (2.7 to 3.1)
Nabco	19.05 mm ($\frac{3}{4}$ in) Tandem master cylinder	Primary side	Do not disassemble			
		Secondary side	50 to 51 (1.969 to 2.008)	1.4 (0.055)	33 (0.299)	2.5 to 3.1 (5.5 to 6.8)
	17.46 mm ($\frac{11}{16}$ in) Tandem master cylinder	Primary side	Do not disassemble			
		Secondary side	50 to 51 (1.969 to 2.008)	1.2 (0.047)	26.5 (1.043)	2.3 to 2.7 (5.1 to 6.0)
	17.46 mm ($\frac{11}{16}$ in) Single master cylinder		91 (3.583)	1.2 (0.047)	60 (2.362)	1.3 to 1.7 (2.9 to 3.8)

BRAKE SYSTEM

4. When master cylinder is disassembled, be sure to discard cups and valves. Replace any other part which shows evidence of defomation, wear or otherwise damage.

5. Replace damaged oil reservoirs and caps.

BRAKE LINE

The brake line is different from the following types of master cylinder.

Tandem master cylinder with Master-Vac

Tandem master cylinder without Master-Vac

Single master cylinder

Furthermore, the classification is divided by steering column location, wheelbase, etc.

Right hand drive vehicles

Left hand drive vehicles

Standard wheelbase Pick-up

Long wheelbase Pick-up

Double Pick-up

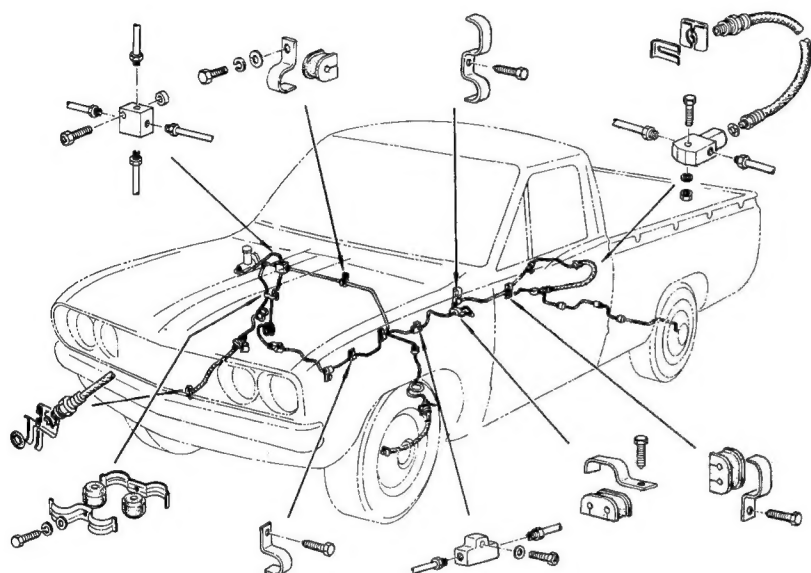


Fig. BR-12 Brake line of R.H. drive (Single master cylinder)

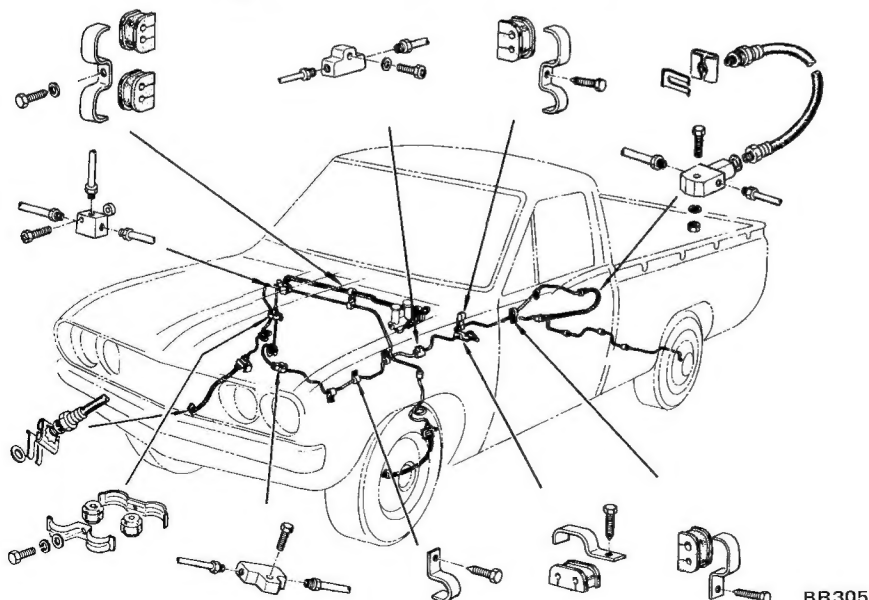


Fig. BR-13 Brake line of L.H. drive (Tandem master cylinder)

Removal

1. Removing flare nuts on both ends and clips effects the removal of brake tube and brake hose.

2. Rear brake hose can be removed by disconnecting the tube and then turning round the hose.

Installation

Brake hose

Front brake hose

In installing brake hose, first jack up vehicle to take off the weight of vehicle from wheels so that suspension is in rebound. Steering wheel should also be kept in straight-ahead position.

To connect brake line, first connect brake hose to wheel cylinder with the specified torque.

Tightening torque:

1.7 to 2.0 kg-m
(12 to 14 ft-lb)

Then secure brake hose to the bracket with lock plate not so as to twist or abnormal bend the hose.

Note: After connecting brake hose at both ends, pay keen attention not to twist the hose when additional tightening is required.

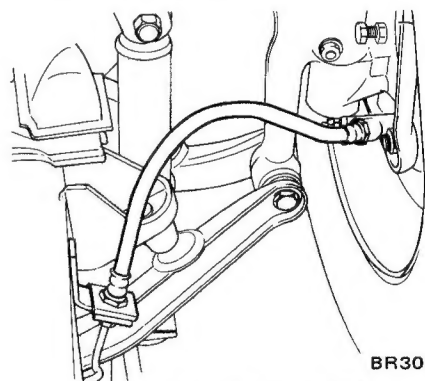


Fig. BR-14 Front brake hose

Rear brake hose

First, secure rear brake hose to 3-way connector on rear axle case to the specifications. After connecting hose, do not tighten it at 3-way connector additionally since this operation gives hose to be twisted.

Tightening torque:

1.7 to 2.0 kg-m
(12 to 14 ft-lb)

BRAKE SYSTEM

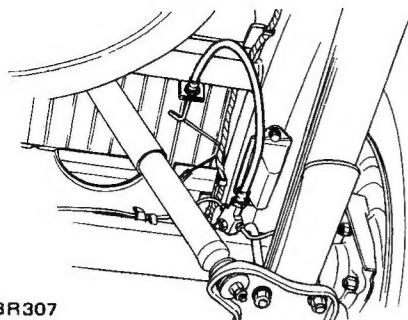


Fig. BR-15 Rear brake hose

After brake hose has been installed, check to be sure that there is enough clearance between hose and adjacent parts to avoid contact with other ones. The check should be carried out while moving wheel up and down through its full stroke and rotating steering wheel between two extreme lock positions. The above clearance must be as follows:

Hose to rotating or moving parts such as tire and rim:

40 mm (1.6 in) and more

Hose to stationary part:

25 mm (1 in) and more

In case that the above clearance cannot be obtained, it may be caused by the hose twisted. Accordingly, carry out the correction with hose connection again, following the above instructions.

Brake tube

In installing a brake tube, use care to locate its end squarely on mating seat, noting the fact that nut can be turned freely by a light finger twist. Then, tighten to correct torque with a Brake Pipe Torque Wrench GG94310000.

Tightening torque (Flare nut):

1.5 to 1.8 kg-m
(11 to 13 ft-lb)

In addition, care should also be exercised to avoid damaging or collapsing brake tube during operation.

Be sure to make enough clearance between all tubes and other adjacent parts to avoid contact.

In installing tube through hood ledge grommet, be sure to position it

at the center of grommet.

After connecting brake tube, be sure to check the clearance to prevent from damage. The clearance at the following portions must be specified distance or more.

Tube to body panel and frame:

Over 4 mm (0.16 in)

Tube to edge of each panel:

Over 10 mm (0.40 in)

Tube to tube:

Loop pitch:

Over 5 mm (0.20 in)

Between front tube and

rear tube:

Over 10 mm (0.40 in)

Tube to moving parts:

Over 10 mm (0.40 in)

Loop tube to hood ridge panel:

Over 10 mm (0.40 in)

Notes:

- Brake tubes are shaped at factory to secure specified clearance and may not require reshaping. Discard if they call for excessive reshaping.
- In reshaping a brake tube, take care to avoid damaging galvanization or collapsing section.

After brake lines have been assembled, check to make sure that all fittings and flare nuts are tightened to correct torques.

Tightening torque:

Brake tube to connector

1.5 to 1.8 kg-m
(11 to 13 ft-lb)

Brake tube to brake hose

1.7 to 2.0 kg-m
(12 to 15 ft-lb)

Connector and clip fixing bolt

0.35 to 0.45 kg-m
(2.5 to 3.3 ft-lb)

3-way connector fixing bolt

(on rear axle case)

0.8 to 1.1 kg-m
(5.8 to 8.0 ft-lb)

Inspection

Brake hose

- Examine all hoses for swell, rubbing marks or ozone-cracking, replacing those found with any of above badly

beyond use. Also, inspect end fittings and be sure that no fluid leak through staked end has taken place; replace if necessary. Hose with badly rusted fitting should also be replaced with a new one. As to installation notes, refer to relative topic under "Installation."

- Retighten all connection, if necessary, to assist in obtaining correct torque. In retightening at front wheel cylinder, first remove hose clamp and loosen flare nut on opposite side to avoid twisting hose.

Brake tube

Clean all tubes to remove dust and dirt with isopropyl alcohol, checking for collapse, wear, cracking, swell or rusting. Replace if found with any of above. Use care not to damage brake tubes while operation.

Check if tubes are clamped securely.

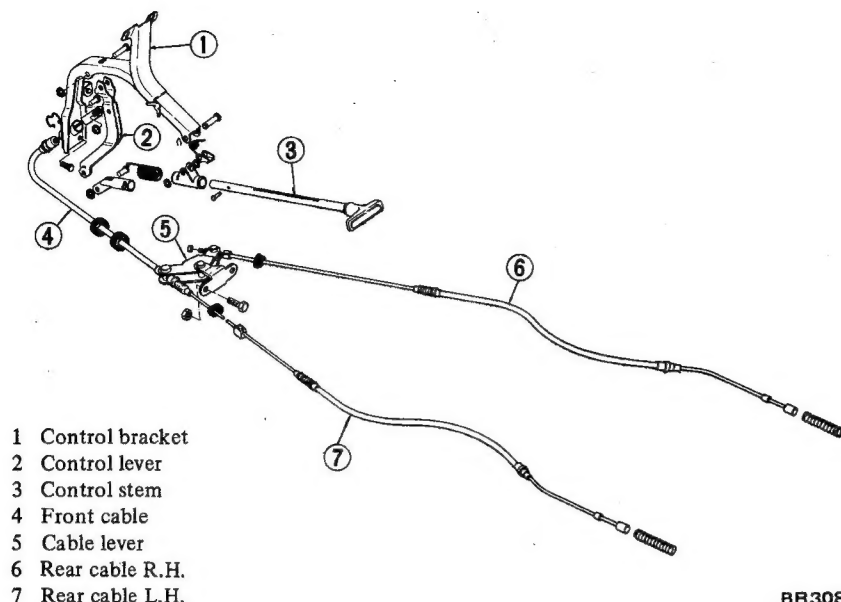
After the above steps have been carried out, hold pedal as far downward as possible 80 kg (176 lb) or more, examining evidence as to whether fluid is leaking through brake lines or connections. Leakage in any manner cannot be permitted here. In case fluid leaks, tightening with specified torque, tighten additionally up to 2.5 kg-m (18 ft-lb). Under no circumstances should nut be tightened over 2.5 kg-m (18 ft-lb) torque since this elongates end fitting, making it impossible to reuse brake tube.

Under no circumstances should rear brake hose and 3-way connector be retightened over specified torques. Instead, replace copper washer with a new one after checking for sign of damage on seating surface. Never reuse an old copper washer.

HAND BRAKE (Parking brake)

A hand operated hand brake is of stick type, which actuates rear wheel brake shoes. All the cable adjustment can be made by operating only adjusting nut at cable lever.

BRAKE SYSTEM



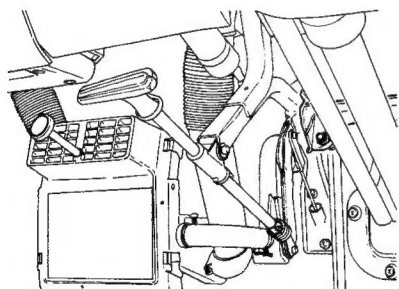
BR308

Fig. BR-16 Hand brake linkage

Removal

Control stem

1. Disconnect terminal from hand brake warning switch.
2. Remove nuts securing control bracket in place on dash panel.
3. Pull out lock pin and cotter pin, and then remove control stem assembly.



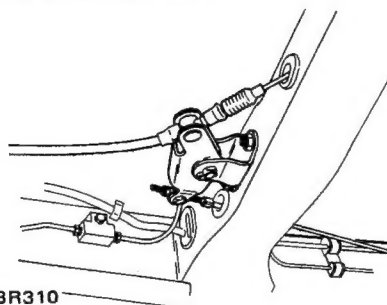
BR309

Fig. BR-17 Control stem

Cable

1. Fully release hand brake lever.
2. Loosen adjusting nut at cable lever.
3. Disconnect cable from control lever.
4. Remove both sides rear brake drums, and disconnect rear cable from toggle lever.
5. Detach lock plate, spring and clip and pull out cable to cable lever.

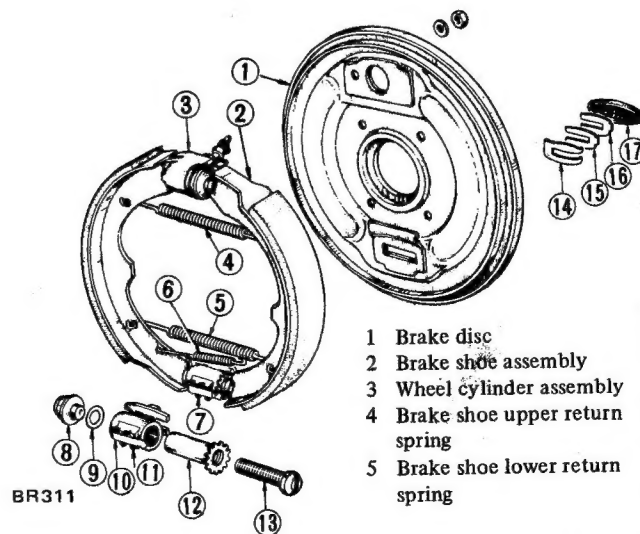
6. Remove cotter pin at cable lever and disconnect cable.



BR310

Fig. BR-18 Cable lever

FRONT BRAKE



BR311

BR-9

Installation

Install hand brake assembly in the reverse sequence of removal by closely observing the following instructions.

1. When installing, apply a coating of grease to sliding contact surfaces. Make sure that each sliding part functions smoothly.
2. Upon completion of installation of hand brake assembly, adjust the entire system as per instructions described under topic "ADJUSTMENT."
3. Make sure that each cable is not interfered with by any adjacent parts. Do not apply an undue stress to cables.

Inspection

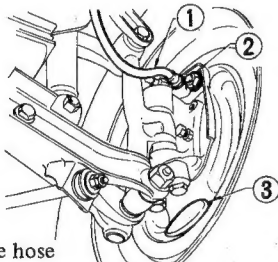
1. Check control stem and ratchet for evidence of wear or other damages. Replace parts which are defective.
2. Replace worn or fatigued springs.
3. Check wires for evidence of discontinuity or other deterioration. Replace if necessary.
4. Replace defective warning light and/or switch.
5. Check parts at each connection and, if found deformed or damaged, replace.

Fig. BR-19 Front brake

BRAKE SYSTEM

Removal

1. Jack up front of vehicle just high enough to remove tire and support it with safety stands.
2. Remove wheel and brake drum. When brake drum cannot be removed easily, return brake adjuster.
3. In order to ease operation, remove hub assembly from knuckle spindle. (Refer to "FRONT AXLE.")
4. Unhook upper, lower, and after shoe return springs, and then remove brake shoe assemblies.
5. Disconnect brake hose from wheel cylinder.
6. Loosen securing nut and remove wheel cylinder.
7. Remove rubber boot, adjuster shim, lock plate and retaining spring, and then remove adjuster assembly from brake disc.



- 1 Brake hose
- 2 Wheel cylinder attaching bolt
- 3 Rubber boot

BR312

Fig. BR-20 Removing wheel cylinder

Installation

Install front brake in reverse sequence of removal, paying particular attention to the following instructions.

1. When assembling adjuster assembly, apply brake grease to adjuster housing bore, adjuster wheel and adjuster screw.

When installing adjuster assembly to brake disc, apply brake grease to disc, adjuster and retaining spring sliding surfaces to slide adjuster smoothly.

Measure adjuster sliding resistance. Adjust by adjuster shim when sliding resistance is incorrect.

Adjuster sliding resistance
5 to 12 kg (11.0 to 26.5 lb)

2. When installing wheel cylinder, be sure to secure the cylinder with "R"

mark to right hand disc and the one with "L" mark to left hand disc. Otherwise, brake hoses may interfere with other adjacent parts. As to the connecting instructions of brake hose, no twist or contact is existed on brake hose, referring the related topic "BRAKE LINE."

Tightening torque:

Wheel cylinder
5.4 to 6.6 kg-m
(39 to 48 ft-lb)

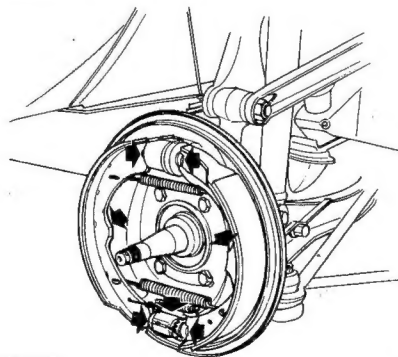
Connector bolt
1.9 to 2.5 kg-m
(14 to 18 ft-lb)

Brake hose
1.7 to 2.0 kg-m
(12 to 14 ft-lb)

Air bleeder
0.7 to 0.9 kg-m
(5.1 to 6.5 ft-lb)

Brake disc
4.2 to 5.0 kg-m
(30 to 36 ft-lb)

3. Before installing brake shoe assemblies, apply brake grease to wheel cylinder and adjuster brake shoe installing grooves, and brake disc and brake shoe assembly contact faces (two places). Exercise care not to allow grease coming into contact with linings and adjuster.



BR313

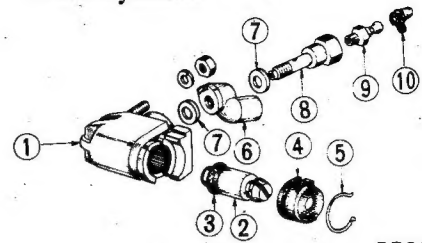
Fig. BR-21 Greasing points

4. Adjust brake shoe clearance and bleed brake system. (Refer to the instructions under topic "ADJUSTMENT" in this section.

Upon completion of the above adjustments, make sure that brake operates correctly and no brake fluid leaks.

Disassembly and assembly

Wheel cylinder



BR314

- 1 Wheel cylinder housing
- 2 Piston
- 3 Piston cup
- 4 Dust cover
- 5 Snap ring
- 6 Connector
- 7 Packings
- 8 Connector bolt
- 9 Bleeder screw
- 10 Bleeder cap

Fig. BR-22 Front wheel cylinder

Wheel cylinder can be disassembled simply by the following procedures described below:

Remove snap ring and dust cover, and take out piston from wheel cylinder. Be careful not to damage sliding part of piston and piston cup.

Thoroughly wash all disassembled parts in brake fluid or alcohol.

Note: Do not wash rubber parts with mineral oil since they are deteriorated.

When alcohol is used, however, do not immerse rubber parts in alcohol longer than 30 seconds. After parts are cleaned, dry them with compressed air.

Assemble wheel cylinder in reverse sequence to disassembly.

When securing connector bolt, insert its location tip to the hole of wheel cylinder firmly and tighten it securely.

Carry out operations carefully so that component parts are not damaged or no dust and other foreign materials enter cylinder.

Inspection

Brake drum

1. Replace brake drum whose diameter is beyond the limit of 1.5 mm (0.0591 in) with respect to the standard inner diameter of 254.0 mm (10 in).

BRAKE SYSTEM

2. The allowable maximum "out-of-round" of brake drum is 0.02 mm (0.0008 in).

Re-condition or replace brake drum if specified limit is exceeded.

3. Measure for tapered brake drum. If specified limit of 0.02 mm (0.0008 in) is exceeded as measured at a position where the distance of 45 mm (1.772 in) is kept away from inlet, re-condition or replace brake drum.

4. Contact surface with which linings come into contact should be finished to such an extent that it is ground by a No. 120 to 150 sand-paper.

5. Using a drum racer, finish brake drum by machining if it shows any sign of score marks, partial wear or stepped wear on its contact surface.

Note: After brake drum is completely re-conditioned or renewed, check drum and shoes for proper contact pattern.

Standard dimensions of shoe springs

Item	Free length mm (in)	Dia. of spring mm (in)	No. of coil	Installed length/load mm/kg (in/lb)
Upper	136.5 (5.374)	2 (0.0787)	37	159.5/14 to 16 (6.280/31 to 25)
Lower	134.5 (5.295)	2.3 (0.0906)	35	159.5/21 to 23 (6.280/46 to 51)
After shoe	83.2 (3.276)	1.4 (0.0551)	27.5	99/4 to 5 (3.898/9 to 11)

Wheel cylinder

1. Replace any cylinder or piston which is scratched, scored or worn on its sliding contact surface.

2. Replace worn parts if piston-to-cylinder clearance is beyond 0.15 mm (0.0059 in).

Wheel cylinder inner diameter
19.05 mm ($\frac{3}{4}$ in)

3. Replace piston cup which is worn or otherwise damaged.

4. Replace if contacting face of cylinder and shoe is worn locally or in step.

5. Replace damaged dust cover, fatigued piston spring or defective threaded parts.

6. Replace tube connector which is worn on its threaded portion.

Brake assembly

1. When brake shoe linings are cracked, incompletely seated, unevenly worn, and/or deteriorated due to excessive heating or soiled with oil, grease and brake fluid, replace.

2. Replace linings if the thickness is worn down to less than 1.0 mm (0.0394 in).

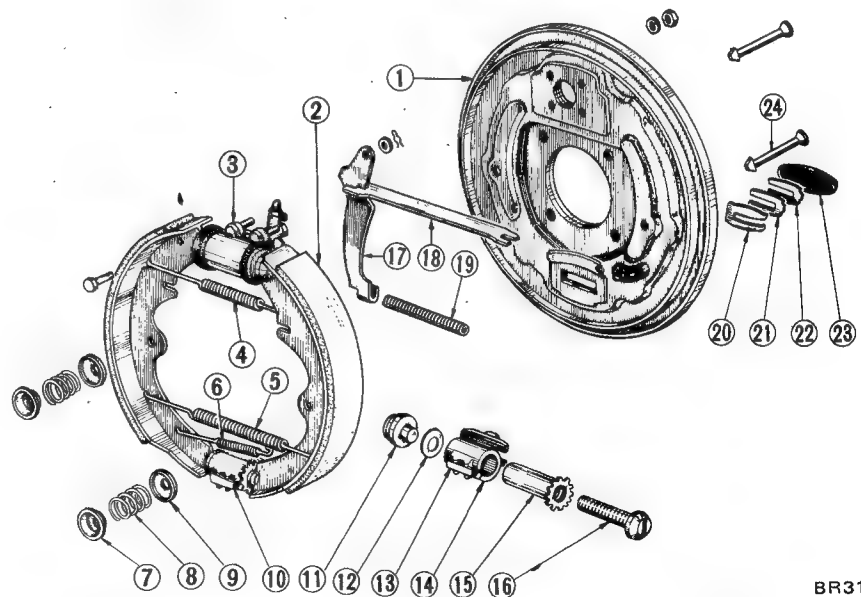
Note: When brake shoe lining is installed, grind brake shoe lining face to diameter equal to that of brake drum.

Lining dimension

Width x Thickness x Length
45 x 4.5 x 244 mm
(1.772 x 0.177 x 9.606 in)

3. Check adjuster for smooth operation.

4. Replace shoe return springs which are broken or fatigued.



- | | | |
|----------------------------|-----------------------|--------------------|
| 1 Brake disc | 9 Spring seat | 17 Toggle lever |
| 2 Brake shoe assembly | 10 Adjuster assembly | 18 Extension link |
| 3 Wheel cylinder assembly | 11 Adjuster head | 19 Return spring |
| 4 Return upper spring | 12 Adjuster head shim | 20 Adjuster spring |
| 5 Return lower spring | 13 Lock spring | 21 Lock plate |
| 6 After shoe return spring | 14 Adjuster housing | 22 Adjuster shim |
| 7 Retainer | 15 Adjuster wheel | 23 Rubber boot |
| 8 Antirattle spring | 16 Adjuster screw | 24 Antirattle pin |

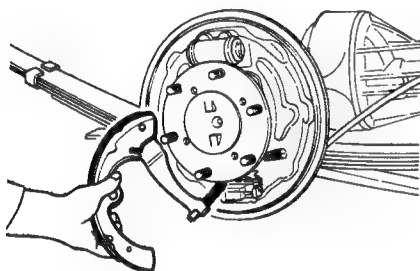
BR315

Fig. BR-23 Rear brake

BRAKE SYSTEM

Removal

1. Jack up rear of vehicle just high enough to remove tire and support it with safety stands.
2. Remove wheel, loosen hand brake and detach brake drum.
3. Turn pin by 90°, and remove antirattle springs.
4. Open brake shoe assemblies outward against return spring, and remove extension link.
5. Remove return springs.
6. Remove brake shoe assemblies. Note that after (secondary) brake shoe assembly must be separated from toggle lever. When separating after (secondary) brake shoe assembly from toggle lever, withdraw clevis pin.
7. Disconnect toggle lever from hand brake rear cable.



BR316

Fig. BR-24 Removing toggle lever

8. Disconnect brake tube at wheel cylinder by loosening flare nut.
9. Remove wheel cylinder from brake disc by loosening installation nuts.
10. Remove rubber boot, adjuster shim, lock plate and adjuster springs and remove adjuster assembly from brake disc.

Installation

Install rear brake in reverse sequence of removal, paying particular attention to the following instructions.

1. Rear adjuster assembly is the same as front. Refer to the paragraph covering front brake installation.

Adjuster sliding resistance:
5 to 12 kg (11.0 to 26.5 lb)

2. When assembling toggle lever and after brake shoe assembly, adjust clear-

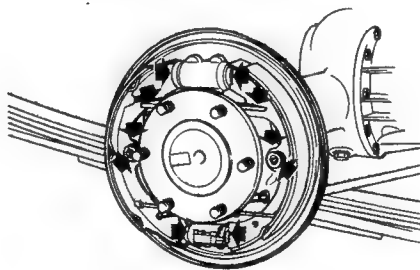
ance between toggle lever and after brake shoe assembly to 0 to 0.3 mm (0 to 0.0118 in) with a properly selected toggle pin washer.

Toggle pin washer	
No.	Thickness mm (in)
1	2.0 (0.079)
2	2.3 (0.091)
3	2.6 (0.102)
4	2.9 (0.114)
5	3.2 (0.126)

3. Before installing brake shoe assemblies, apply brake grease to the following places:

- 1) Brake shoe installing grooves of adjuster and wheel cylinder
- 2) Extension link installing grooves
- 3) Lower surface of spring seat
- 4) Contact surfaces between brake disc and brake shoe assembly (six places)

At this time, be sure not to coat brake grease to brake linings.



BR317

Fig. BR-25 Greasing points

4. Tightening torque:

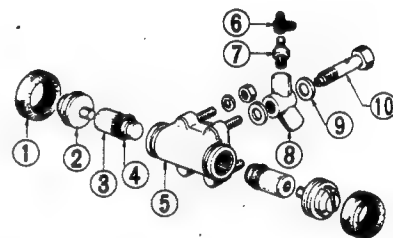
Wheel cylinder	1.5 to 1.8 kg-m (11 to 13 ft-lb)
Connector bolt	1.9 to 2.5 kg-m (14 to 18 ft-lb)
Brake tube	1.5 to 1.8 kg-m (11 to 13 ft-lb)
Air bleeder	0.7 to 0.9 kg-m (5.1 to 6.5 ft-lb)
Brake disc	4.2 to 5.0 kg-m (30 to 36 ft-lb)

5. Adjust brake shoe clearance and bleed brake system. Upon completion of the above adjustments, make sure that brake operates correctly and no brake fluid leaks.

Disassembly and assembly

Wheel cylinder

Remove dust cover, and pull out piston head and piston assembly. Refer to "Wheel cylinder of front brake."



BR318

- 1 Dust cover
- 2 Piston head
- 3 Piston
- 4 Piston cup
- 5 Wheel cylinder housing
- 6 Bleeder cap
- 7 Bleeder screw
- 8 Connector
- 9 Washer
- 10 Connector bolt

Fig. BR-26 Rear wheel cylinder

Inspection

Brake drum

1. Replace brake drum whose diameter is beyond the limit of 1.5 mm (0.059 in) with respect to the standard inner diameter of 254.0 mm (10 in).
2. The allowable maximum "out-of-round" of brake drum is 0.02 mm (0.0008 in). Re-condition or replace brake drum if specified limit is exceeded.
3. Measure for tapered brake drum. If specified limit of 0.02 mm (0.0008 in) is exceeded as measured at a position where the distance of 45 mm (1.772 in) is kept away from inlet, re-condition or replace brake drum.

BRAKE SYSTEM

4. Contact surface with which linings come into contact should be finished to such an extent that it is ground by a No. 120 to 150 sandpaper.

5. Using a drum racer, finish brake drum by machining if it shows any sign of score marks, partial or stepped wear on its contact surface.

Note: After brake drum is completely re-conditioned or replaced, check drum and shoes for proper contact pattern.

Brake assembly

1. When brake shoe linings are cracked, incompletely seated, unevenly worn, and/or deteriorated due to

excessive heating or soiled with oil, grease and brake fluid, replace.

2. Replace linings if the thickness is worn down to less than 1.0 mm (0.0394 in).

Note: When brake shoe lining is installed, grind brake shoe lining face to diameter equal to that of brake drum.

Lining dimension:

Width x Thickness x Length
45 x 4.5 x 244 mm

(1.772 x 0.177 x 9.606 in)

3. Check adjuster for smooth operation.

4. Replace shoe return springs which are broken or fatigued.

2. Replace worn parts if piston-to-cylinder clearance is beyond 0.15 mm (0.0059 in).

Wheel cylinder inner diameter:

19.05 mm (¾ in)

17.46 mm (11/16 in)

(PL620TU only)

3. Replace piston cup which is worn or damaged.

4. Replace if contacting face of cylinder and shoe is worn locally or in step.

5. Replace damaged dust cover, fatigued piston spring or defective threaded parts.

6. Replace tube connector which is worn on its threaded portion.

MASTER-VAC

Description

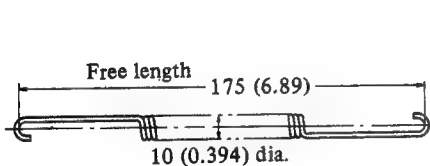
A vacuum suspended Master-Vac is installed behind the master cylinder. As the brake pedal is depressed, fluid is forced under high pressure through the brake pipes to the wheel cylinders to retard or stop the vehicle.

The Master-Vac contains a spring loaded diaphragm of 114.3 mm (4 ½ in) in diameter. It operates on negative pressure produced in the engine intake manifold.

The tandem master cylinder is capable of producing high pressure even if the Master-Vac is defective.

Standard dimensions of shoe springs

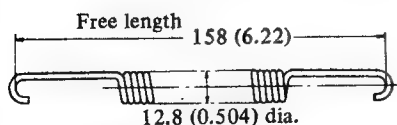
Item	Free length mm (in)	Dia. of spring mm (in)	No. of coil	Installed length/load mm/kg (in/lb)
Upper	175 (6.890)	2 (0.0787)	32.5	184/11 to 13 (7.244/24 to 29)
Lower	158 (6.220)	2.3 (0.0906)	30	176/18 to 20 (6.929/40 to 44)
After shoe	83.2 (3.276)	1.4 (0.0551)	27.5	99/4 to 5 (3.898/9 to 11)
Antirattle	20.5 (0.807)	1.6 (0.0630)	3.5	12/3.5 to 4.5 (0.472/8 to 10)



Unit: mm (in)

BR319

Fig. BR-27 Upper return spring



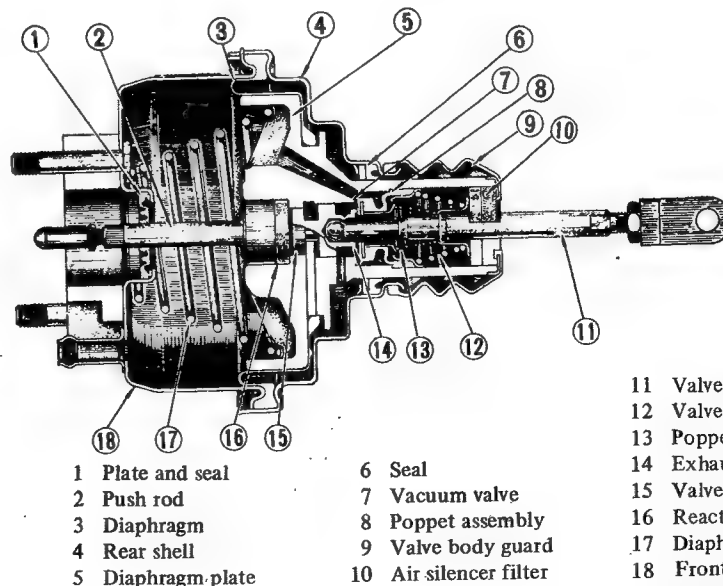
Unit: mm (in)

BR320

Fig. BR-28 Lower return spring

Wheel cylinder

1. Replace any cylinder or piston which is scratched, scored or worn on its sliding contact surface.



BR321

- 1 Plate and seal
- 2 Push rod
- 3 Diaphragm
- 4 Rear shell
- 5 Diaphragm plate

- 6 Seal
- 7 Vacuum valve
- 8 Poppet assembly
- 9 Valve body guard
- 10 Air silencer filter

- 11 Valve operating rod
- 12 Valve return spring
- 13 Poppet return spring
- 14 Exhaust valve
- 15 Valve plunger
- 16 Reaction disc
- 17 Diaphragm return spring
- 18 Front shell

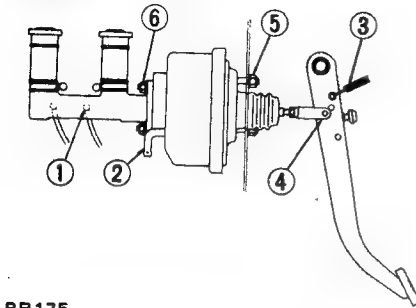
Fig. BR-29 Sectional view of Master-Vac

BRAKE SYSTEM

Removal and installation

Referring to Figure BR-30, remove parts in numerical order enumerated.

Install these parts in the reverse sequence of removal.



BR175

Fig. BR-30 Removal method of Master-Vac

Note: After Master-Vac is properly installed on vehicle, be sure to conduct an air-tight test and operation test described previously in this Section.

Disassembly

When disassembling Master-Vac, observe the following instructions.

- Thoroughly clean mud or dust from Master-Vac.
- Extreme care should be taken not to allow dirt, dust, water or any other foreign matter getting into any component-parts.
Be sure to select a clean place before disassembly or assembly.
- Mark mating joints so that they may be installed exactly in their original positions.
- Keep all disassembled parts arranged properly so that they may readily be assembled at any time.
- Clean rubber parts and synthetic resin parts in alcohol.
- After all disassembled parts are cleaned in a suitable clean solvent, place on a clean work bench. Use care not to allow dirt and dust coming into contact these parts.

- Install spacer on rear shell spacer temporarily. Place Master-Vac in a vise. Use soft jaws in suggested.
- Remove clevis and lock nut. Detach valve body guard.

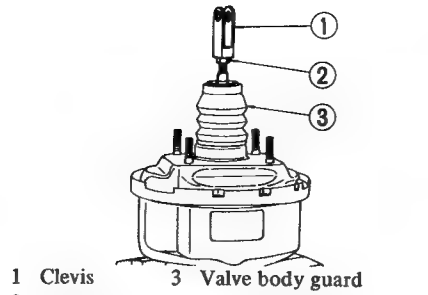


Fig. BR-31 Removing rear shell

- Identify front shell and rear shell clearly so that they may be reassembled in their original positions from which they were withdrawn. (Bolts attached on dashboard are not the same in pitch.)
- Using Master-Vac Wrench ST08080000, remove rear shell-seal assembly, and disassemble diaphragm plate assembly, front shell assembly, diaphragm spring and push rod assembly.

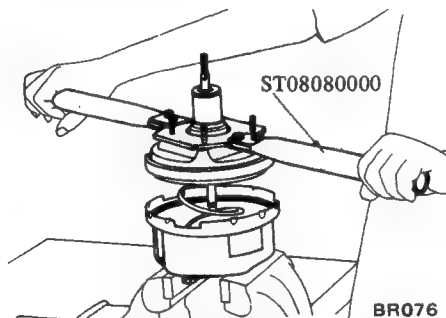
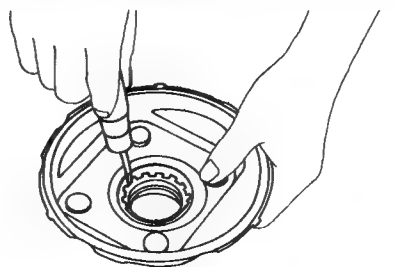


Fig. BR-32 Removing rear shell

Rear shell-seal

Pry off retainer with use of screwdriver as shown and detach bearing and seal.

Note: Do not disassemble seal assembly unless absolutely necessary. Whenever this is to be removed, use care not to damage it.

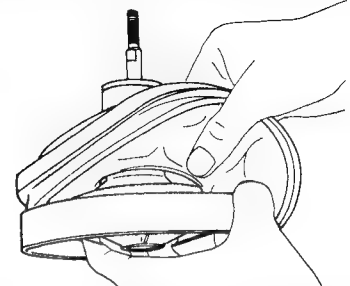


BR078

Fig. BR-33 Removing retainer

Diaphragm plate

- Place diaphragm plate assembly on a clean work bench. Detach diaphragm from groove in plate as shown.

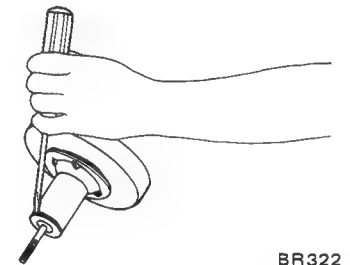


BR079

Fig. BR-34 Separating diaphragm

- Using a screwdriver as shown, evenly pry air silencer retainer until it is detached from diaphragm plate assembly.

Note: Never use a hammer to remove this retainer since this will be the sure way of damaging it.

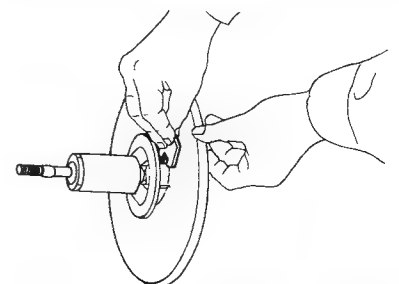


BR322

Fig. BR-35 Removing air silencer retainer

- Pull out valve plunger stop key and withdraw silencer and plunger assembly.

Note: To remove valve plunger stop key properly, proceed as follows: With key hole facing down, lightly push valve operating rod simultaneously while applying vibration to it.



BR180

Fig. BR-36 Pulling out stop key

BRAKE SYSTEM

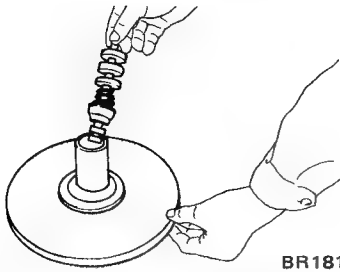


Fig. BR-37 Removing valve operating rod assembly

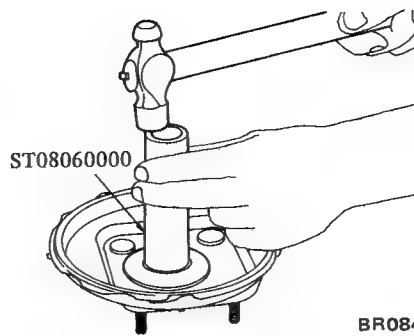


Fig. BR-40 Installing oil seal

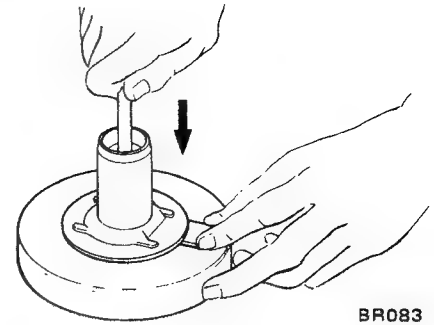
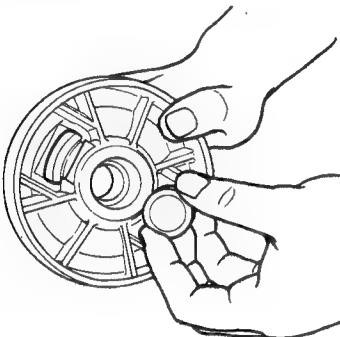


Fig. BR-43 Inserting stop key

4. Withdraw reaction disc.

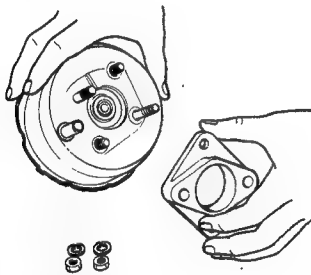


BR286

Fig. BR-38 Removing reaction disc

Front shell-seal

1. Detach flange from front shell assembly.



BR287

Fig. BR-39 Removing flange

2. Withdraw front seal assembly.

Assembly

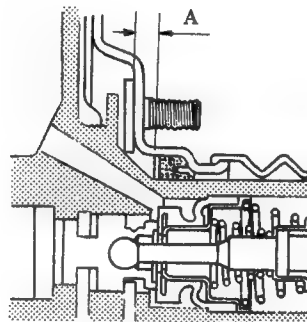
Assemble in the reverse sequence of disassembly.

Rear shell-seal

1. Apply a coating of Master-Vac grease to the sealing surface and lip of seal, and install that seal in rear shell with the use of Master-Vac Oil Seal Retainer Drift ST08060000.

Note: Referring to Figure BR-41, install seal in place by properly aligning the pawl of special tool with seal hole. Adjustment is correct when specified length at "A" is obtained.

Length "A"
6.7 to 7.0 mm
(0.264 to 0.276 in)

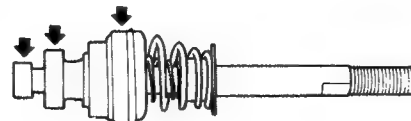


BR185

Fig. BR-41 Length at "A"

Diaphragm plate

1. Apply a thin coating of grease to the sliding contact portion on the periphery of plunger assembly.



BR186

Fig. BR-42 Requiring grease place

2. Install plunger assembly and silencer in diaphragm plate, and lightly push plunger stop key in place.

Note: Diaphragm plate is made of bakelite. Exercise care in installing plunger assembly not to damage diaphragm plate.

3. Before installing diaphragm into position, apply a thin coating of mica-power to it except outer diameter and seating portion with which shell comes into contact.

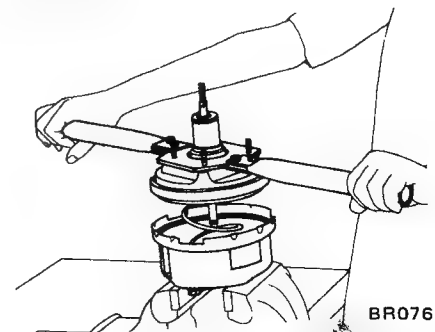
4. Before installing reaction disc in place on diaphragm plate, apply a thin coating of Master-Vac grease.

Front shell-seal

Before installing front shell-seal assembly, apply a coating of Master-Vac grease to the inner wall of seal and front shell with which seal comes into contact.

Final assembly

1. Apply a thin coating of Master-Vac grease to the outer edges of diaphragm with which rear and front shells come into contact, before installing diaphragm in position.
2. Before installing push rod assembly in place, apply a coating of Master-Vac grease to the sliding contact surface of diaphragm plate.
3. Align marks scribed in the rear shell and front shell. Carefully turn the Master-Vac Wrench ST08080000 clockwise until it reaches notch in shell retainer.



BR076

Fig. BR-44 Tightening rear shell

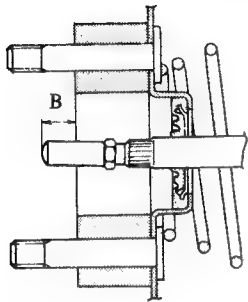
BRAKE SYSTEM

4. After assembly, adjust the length of push rod to less than the specified value indicated below. Length adjustment of push rod is made at the tip of push rod.

Length "B"

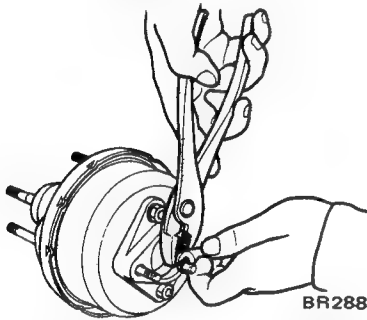
10 to 10.5 mm

(0.3937 to 0.4134 in)



BR290

Fig. BR-45 Length at "B"



BR288

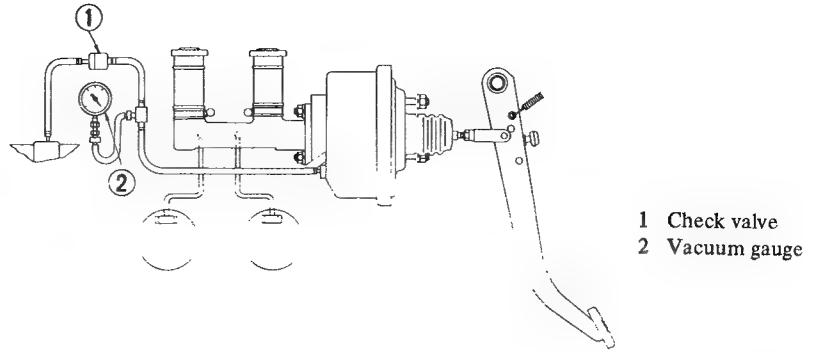
Fig. BR-46 Adjusting push rod length

Inspection

1. Check poppet assembly for condition. If it shows evidence of wear or damage, replace it and valve operating rod assembly.
2. Check other component-parts for condition. If any part shows evidence of wear or damage, replace it with a new one.

Vacuum pressure

1. Connect a vacuum gauge, in the line, between check valve and Master-Vac, as shown in Figure BR-47.



- 1 Check valve
- 2 Vacuum gauge

BR169

Fig. BR-47 Air-tight test set-up

2. Start engine and increase engine speed. Stop engine when vacuum gauge indicates 500 mmHg (19.7 in Hg).

Air-tight test

1. Fifteen seconds after engine is

stopped, observe the rate of drop in air pressure registered by vacuum gauge. If a pressure drop of 25 mmHg (0.984 in Hg) is exceeded, refer to the following chart to determine the cause of failure.

Probable cause	Corrective action
1. Air leakage at check valve.	Replace check valve.
2. Air leakage at push-rod seal.	Replace seal.
3. Air leakage between valve body and seal.	Repair or replace faulty part(s).
4. Air leakage at valve plunger seat.	Repair or replace seat.
5. Damaged piping or joints.	Repair or replace.

2. Fifteen seconds after engine is stopped and brake fully applied, observe the rate of drop in air pressure registered by vacuum gauge.

If a pressure drop of 25 mmHg (0.984 in Hg) is exceeded, refer to the following chart to determine the cause of failure.

Probable cause	Corrective action
1. Air leakage at check valve.	Replace check valve.
2. Damaged diaphragm.	Replace.
3. Reaction disc dropped off.	Reinstall and check push rod for proper turn.
4. Air leakage at poppet assembly seat and valve body.	Replace defective part(s).

Note: When replacement of any part is required, be sure to renew Master-Vac as an assembly.

Check valve

1. Remove clip and disconnect hoses at connections. The check valve can now be removed.

BRAKE SYSTEM

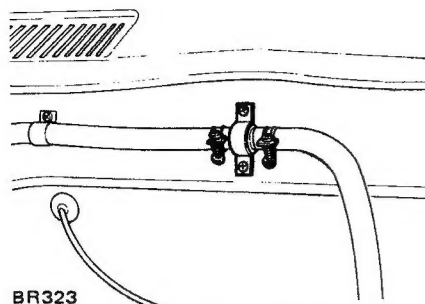
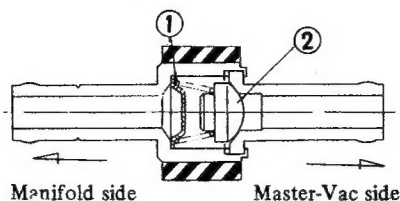


Fig. BR-48 Location of check valve

2. Using a Master-Vac tester, apply a vacuum pressure of 500 mmHg (19.7 in Hg) to the port of check valve on the Master-Vac side. If a pressure drop of 10 mmHg (0.394 in Hg) is exceeded in 15 seconds, replace check valve with a new one.
3. When pressure is applied to the Master-Vac side of check valve and valve does not open, replace check valve with a new one.



1 Spring 2 Valve BR289
Fig. BR-49 Sectional view of check valve

Operation test

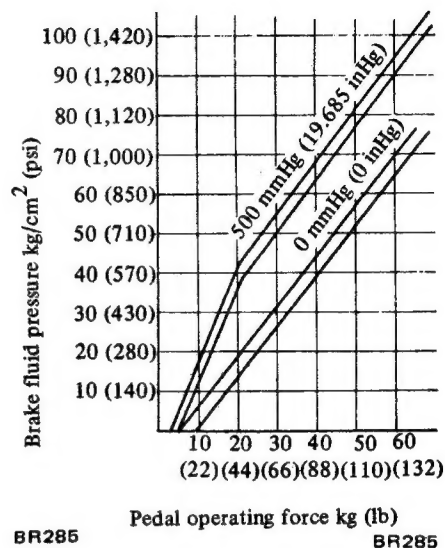
1. Connect an oil pressure gauge, in brake line, at connection on master cylinder.
2. Install a spring scale on brake pedal.
3. Start engine, and increase engine speed until a vacuum pressure of 500 mmHg (19.7 in Hg) is registered on vacuum pressure gauge. With a vacuum pressure of 500 mmHg (19.7 in Hg) held, measure an oil pressure with respect to each pedal operating force.

Relationship between oil pressure and pedal operating force is illustrated in Figure BR-50. If test results are not as specified in Figure BR-50, check Master-Vac for condition in a manner

as described under "Inspection," before removal of this unit.

Also check brake line for evidence of fluid leakage.

Note: Determine whether a trouble occurs in Master-Vac or in check valve. Always inspect check valve first.



BR285 BR285
Fig. BR-50 Performance curves of Master-Vac

SERVICE DATA AND SPECIFICATIONS

Brake type:

Front	Uni-servo
Rear	Duo-servo
Hand brake	Mechanically-operated on rear wheels

Brake pedal:

Free height	mm (in)	R.H. drive 163 (6.42) L.H. drive 140 (5.51)
Full stroke of pedal head	mm (in)	126 to 132 (4.96 to 5.20)

Brake adjustment notches:

Front	12
Rear	12

Hand brake normal stroke:	mm (in)	80 to 100 (3.15 to 3.94)
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Master cylinder:

Inner diameter	mm (in)	17.46 ($\frac{11}{16}$) (Single and Tandem) 19.05 ($\frac{3}{4}$) (Tandem)
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Allowable maximum clearance between cylinder and piston	mm (in)	0.15 (0.0059) maximum
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BRAKE SYSTEM

Wheel cylinder:

Inner diameter	Front	mm (in)	19.05 (¾)
	Rear	mm (in)	19.05 (¾)
			17.46 (11/16) (PL620TU)

Allowable maximum clearance between cylinder and piston	mm (in)	0.15 (0.0059) maximum
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Brake drum:

Inner diameter	Front and Rear	mm (in)	254.0 (10)
Inside out-of-round		mm (in)	0.02 (0.0008) maximum
Repair limit of drum in diameter			
	Front and Rear	mm (in)	255,5 (10.059)

Lining:

Dimension	Front and Rear		
Width × Thickness × Length	mm (in)	45 × 4.5 × 244	(1.772 × 0.177 × 9.61)

Allowable maximum wear limit	mm (in)	1 (0.0394)
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Adjuster sliding resistance	kg (lb)	5 to 12 (11.0 to 26.5)
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Tightening torque

Unit: kg-m (ft-lb)

Brake master cylinder attaching nut	0.8 to 1.2	(5.8 to 8.7)
Brake tube connection	1.5 to 1.8	(11 to 13)
Brake hose connection	1.7 to 2.0	(12 to 14)
Air bleeder valve	0.7 to 0.9	(5.1 to 6.5)
Connector and clip fixing bolt	0.35 to 0.45	(2.5 to 3.3)
3-way connector fixing bolt (on rear axle case)	0.8 to 1.1	(5.8 to 8.0)
Fulcrum pin of brake pedal	1.9 to 2.4	(14 to 17)
Pedal stopper lock nut	1.2 to 1.5	(8.7 to 11)
Push rod adjusting nut	1.9 to 2.4	(14 to 17)
Wheel cylinder mounting bolt		
Front	5.4 to 6.6	(39 to 48)
Rear	1.5 to 1.8	(11 to 13)
Wheel cylinder connector bolt	1.9 to 2.5	(14 to 18)
Brake disc attaching bolt	4.2 to 5.0	(30 to 36)

BRAKE SYSTEM

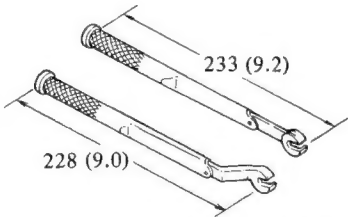
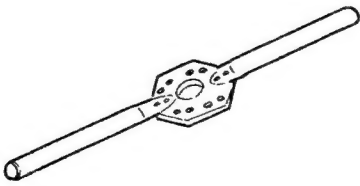
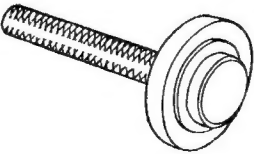
TROUBLE DIAGNOSES AND CORRECTIONS

Condition	Probable cause	Corrective action
Spongy pedal.	Air in brake lines. Swollen hose due to deterioration or use of poor quality hose. Use of a brake fluid of which boiling point is too low. Reservoir filler cap vent hole clogged. (This promotes a vacuum in master cylinder that sucks in air through rear seal.)	Bleed thoroughly. Replace hose and bleed system. Change with specified brake fluid and bleed system. Clean and bleed system.
Pedal yields under slight pressure.	Deteriorated check valve. External leaks. Leakage on master cylinder.	Replace check valve and bleed system. Check master cylinder, piping and wheel cylinder for leaks and repair. Overhaul master cylinder.
Excessive pedal travel.	Air in system. Shoes out of adjustment. Insufficient fluid in master cylinder. Thermal expansion of drums because of excessive overheating.	Bleed system. Adjust shoe-to-drum clearance. Fill up with specified brake fluid and bleed system. Allow drums to cool off. Check brake shoe linings and drums. Replace damaged parts.
All brakes drag.	Insufficient shoe-to-drum clearance. Weak shoe return springs. No free travel of brake pedal. Seized master cylinder piston.	Adjust clearance. Replace. Adjust pedal height. Disassemble master cylinder and replace piston. Bleed system.
One brake drags.	Loose or damaged wheel bearings. Weak, broken or unhooked brake shoe return springs. Insufficient clearance between brake shoe and drum.	Adjust or replace as required. Replace. Adjust brakes.
Unbalanced brakes.	Grease or oil on linings. Seized piston in wheel cylinder. Improper tire inflation. Loose wheel bearings. Faulty front suspension.	Clean brake mechanism; check cause of trouble. Replace linings. Service wheel cylinder and bleed system. Inflate to correct pressure. Adjust. Check and adjust all front suspension parts.

BRAKE SYSTEM

Condition	Probable cause	Corrective action
Excessive pedal pressure required, poor brakes.	Grease, mud or water on brake shoe linings. Full area or linings not contacting drums. Scored brake drums.	Remove drums and clean and dry linings or replce. Replace shoes. Reface drums and install new linings.
Brake chatter, squeak or squeal.	Dust on drums or linings. Weak shoe return springs. Drum out-of-round. Worn linings.	Remove and clean drums. Check and, if necessary, replace springs. Turn drums on lathe. Replace.

SPECIAL SERVICE TOOLS

No.	Tool number & tool name	Description Unit: mm (in)	For use on	Reference page or figure No.
1.	GG94310000 Brake pipe torque wrench	 SE227	<p>This tool is used to tighten and untighten brake tube flared nut. A built-in torque limiting wrench is provided to assure torque accuracy.</p>	<p>All models</p> <p>Page BR-8</p>
2.	ST08080000 Master-Vac, wrench	 SE073	<p>This tool is used to remove rear shell after aligning rear shell stud bolt with the opening in this tool.</p>	<p>620 610 510 S30 C30 230 C10 GC10</p> <p>Fig. BR-32</p>
3.	ST08060000 Master-Vac oil seal retainer drift	 SE115	<p>This tool is used when rear shell seal is driven into position.</p> <p>Note: Make sure that this tool is pushed in until rear guide of this tool touches rear shell.</p>	<p>620 610 510 S30 C30 230 C10 GC10</p> <p>Fig. BR-40</p>